

# BOTTOM BARYONS

## ( $B = -1$ )

$$\Lambda_b^0 = u d b, \Xi_b^0 = u s b, \Xi_b^- = d s b, \Omega_b^- = s s b$$

 **$\Lambda_b^0$** 

$$I(J^P) = 0(\frac{1}{2}^+)$$

NODE=BXXX045

$I(J^P)$  not yet measured;  $0(\frac{1}{2}^+)$  is the quark model prediction.

Mass  $m = 5619.4 \pm 0.6$  MeV

$m_{\Lambda_b^0} - m_{B^0} = 339.2 \pm 1.4$  MeV

$m_{\Lambda_b^0} - m_{B^+} = 339.7 \pm 0.7$  MeV

Mean life  $\tau = (1.429 \pm 0.024) \times 10^{-12}$  s

$c\tau = 428$   $\mu$ m

$A_{CP}(\Lambda_b \rightarrow p\pi^-) = 0.03 \pm 0.18$

$A_{CP}(\Lambda_b \rightarrow pK^-) = 0.37 \pm 0.17$

The branching fractions  $B(b\text{-baryon} \rightarrow \Lambda_b^- \bar{\nu}_\ell \text{anything})$  and  $B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything})$  are not pure measurements because the underlying measured products of these with  $B(b \rightarrow b\text{-baryon})$  were used to determine  $B(b \rightarrow b\text{-baryon})$ , as described in the note "Production and Decay of  $b$ -Flavored Hadrons."

For inclusive branching fractions, e.g.,  $\Lambda_b \rightarrow \bar{\Lambda}_c$  anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

$\Lambda_b^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$J/\psi(1S)\Lambda \times B(b \rightarrow \Lambda_b^0)$	$(5.8 \pm 0.8) \times 10^{-5}$		1740	DESIG=3
$\Lambda_c^+ \pi^-$	$(5.7^{+4.0}_{-2.6}) \times 10^{-3}$	S=1.6	2342	DESIG=11
$\Lambda_c^+ a_1(1260)^-$	seen		2153	DESIG=12
$\Lambda_c^+ \pi^+ \pi^- \pi^-$	$(8^{+5}_{-4}) \times 10^{-3}$	S=1.6	2323	DESIG=4
$\Lambda_c(2595)^+ \pi^-$ , $\Lambda_c(2595)^+ \rightarrow \Lambda_c^+ \pi^+ \pi^-$	$(3.7^{+2.8}_{-2.3}) \times 10^{-4}$		2210	DESIG=22
$\Lambda_c(2625)^+ \pi^-$ , $\Lambda_c(2625)^+ \rightarrow \Lambda_c^+ \pi^+ \pi^-$	$(3.6^{+2.7}_{-2.1}) \times 10^{-4}$		2193	DESIG=23
$\Sigma_c(2455)^0 \pi^+ \pi^-$ , $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$	$(6^{+5}_{-4}) \times 10^{-4}$		2265	DESIG=24
$\Sigma_c(2455)^{++} \pi^- \pi^-$ , $\Sigma_c^{++} \rightarrow \Lambda_c^+ \pi^+$	$(3.5^{+2.8}_{-2.3}) \times 10^{-4}$		2265	DESIG=25
$\Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything}$	[a] $(9.8 \pm 2.2) \%$		—	DESIG=6
$\Lambda_c^+ \ell^- \bar{\nu}_\ell$	$(6.5^{+3.2}_{-2.5}) \%$	S=1.8	2345	DESIG=15
$\Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell$	$(5.6 \pm 3.1) \%$		2335	DESIG=16
$\Lambda_c(2595)^+ \ell^- \bar{\nu}_\ell$	$(8 \pm 5) \times 10^{-3}$		2212	DESIG=18
$\Lambda_c(2625)^+ \ell^- \bar{\nu}_\ell$	$(1.4^{+0.9}_{-0.7}) \%$		2195	DESIG=19
$p h^-$	[b] $< 2.3 \times 10^{-5}$	CL=90%	2730	DESIG=17
$p \pi^-$	$(4.0 \pm 0.8) \times 10^{-6}$		2730	DESIG=9
$p K^-$	$(4.8 \pm 0.9) \times 10^{-6}$		2708	DESIG=10
$\Lambda \mu^+ \mu^-$	$(1.7 \pm 0.7) \times 10^{-6}$		2695	DESIG=26
$\Lambda \gamma$	$< 1.3 \times 10^{-3}$	CL=90%	2699	DESIG=13

 **$\Lambda_b(5912)^0$** 

$$J^P = \frac{1}{2}^-$$

NODE=B162

Mass  $m = 5912.0 \pm 0.6$  MeV

Full width  $\Gamma < 0.66$  MeV, CL = 90%

NODE=B162M;DTYPE=M

NODE=B162W;DTYPE=G

<b><math>\Lambda_b(5912)^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda_b^0 \pi^+ \pi^-$	seen	86

NODE=B162215;DESIG=1

 **$\Lambda_b(5920)^0$** 

$$J^P = \frac{3}{2} -$$

Mass  $m = 5919.8 \pm 0.6$  MeV  
 Full width  $\Gamma < 0.63$  MeV, CL = 90%

<b><math>\Lambda_b(5920)^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda_b^0 \pi^+ \pi^-$	seen	108

NODE=B163

NODE=B163M;DTYPE=M

NODE=B163W;DTYPE=G

<b><math>\Sigma_b</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda_b^0 \pi^-$	seen	108

NODE=B163215;DESIG=1

 **$\Sigma_b$** 

$$I(J^P) = 1(\frac{1}{2}^+)$$

$I, J, P$  need confirmation.

Mass  $m(\Sigma_b^+) = 5811.3 \pm 1.9$  MeV  
 Mass  $m(\Sigma_b^-) = 5815.5 \pm 1.8$  MeV  
 $m_{\Sigma_b^+} - m_{\Sigma_b^-} = -4.2 \pm 1.1$  MeV  
 $\Gamma(\Sigma_b^+) = 9.7^{+4.0}_{-3.0}$  MeV  
 $\Gamma(\Sigma_b^-) = 4.9^{+3.3}_{-2.4}$  MeV

NODE=S026

NODE=S026M+;DTYPE=M

NODE=S026M-;DTYPE=M

NODE=S026DMI;DTYPE=D

NODE=S026W+;DTYPE=G

NODE=S026W-;DTYPE=G

<b><math>\Sigma_b^*</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda_b^0 \pi$	dominant	134

NODE=S026215;DESIG=1

 **$\Sigma_b^*$** 

$$I(J^P) = 1(\frac{3}{2}^+)$$

$I, J, P$  need confirmation.

Mass  $m(\Sigma_b^{*+}) = 5832.1 \pm 1.9$  MeV  
 Mass  $m(\Sigma_b^{*-}) = 5835.1 \pm 1.9$  MeV  
 $m_{\Sigma_b^{*+}} - m_{\Sigma_b^{*-}} = -3.0^{+1.0}_{-0.9}$  MeV  
 $\Gamma(\Sigma_b^{*+}) = 11.5 \pm 2.8$  MeV  
 $\Gamma(\Sigma_b^{*-}) = 7.5 \pm 2.3$  MeV  
 $m_{\Sigma_b^*} - m_{\Sigma_b} = 21.2 \pm 2.0$  MeV

NODE=S062

NODE=S062M+;DTYPE=M

NODE=S062M-;DTYPE=M

NODE=S062DMI;DTYPE=D

NODE=S062W+;DTYPE=G

NODE=S062W-;DTYPE=G

NODE=S062DM;DTYPE=D

<b><math>\Xi_b^*</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda_b^0 \pi$	dominant	161

NODE=S062215;DESIG=1

 **$\Xi_b^0, \Xi_b^-$** 

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

$I, J, P$  need confirmation.

$m(\Xi_b^-) = 5791.1 \pm 2.2$  MeV  
 $m(\Xi_b^0) = 5788 \pm 5$  MeV  
 $m_{\Xi_b^-} - m_{\Xi_b^0} = 3 \pm 6$  MeV  
 Mean life  $\tau_{\Xi_b^-} = (1.56 \pm 0.26) \times 10^{-12}$  s  
 Mean life  $\tau_{\Xi_b^0} = (1.49^{+0.19}_{-0.18}) \times 10^{-12}$  s

NODE=S060

NODE=S060M-;DTYPE=M

NODE=S060M0;DTYPE=M

NODE=S060DM;DTYPE=D

NODE=S060T-;DTYPE=T

NODE=S060T;DTYPE=T;OUR EVAL;  
→ UNCHECKED ←

$\Xi_b$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor	$p$ (MeV/c)
$\Xi_b \rightarrow \Xi^- \ell^- \bar{\nu}_\ell X \times B(\bar{b} \rightarrow \Xi_b)$	$(3.9 \pm 1.2) \times 10^{-4}$	1.4	—
$\Xi_b^- \rightarrow J/\psi \Xi^- \times B(b \rightarrow \Xi_b^-)$	$(1.02^{+0.26}_{-0.21}) \times 10^{-5}$	1779	—

 $\Xi_b(5945)^0$ 

$J^P = \frac{3}{2}^+$

Mass  $m = 5945.5 \pm 2.3$  MeV  
 Full width  $\Gamma = 2.1 \pm 1.7$  MeV

$\Xi_b(5945)^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Xi_b^- \pi^+$	seen	72

 $\Omega_b^-$ 

$I(J^P) = 0(\frac{1}{2}^+)$   
 $I, J, P$  need confirmation.

Mass  $m = 6071 \pm 40$  MeV ( $S = 6.2$ )  
 Mean life  $\tau = (1.1^{+0.5}_{-0.4}) \times 10^{-12}$  s

$\Omega_b^-$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$J/\psi \Omega^- \times B(b \rightarrow \Omega_b^-)$	$(2.9^{+1.1}_{-0.8}) \times 10^{-6}$	1826

 **$b$ -baryon ADMIXTURE ( $\Lambda_b, \Xi_b, \Sigma_b, \Omega_b$ )**

Mean life  $\tau = (1.402 \pm 0.023) \times 10^{-12}$  s

These branching fractions are actually an average over weakly decaying  $b$ -baryons weighted by their production rates at the LHC, LEP, and Tevatron, branching ratios, and detection efficiencies. They scale with the  $b$ -baryon production fraction  $B(b \rightarrow b\text{-baryon})$ .

The branching fractions  $B(b\text{-baryon} \rightarrow \Lambda \ell^- \bar{\nu}_\ell \text{anything})$  and  $B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything})$  are not pure measurements because the underlying measured products of these with  $B(b \rightarrow b\text{-baryon})$  were used to determine  $B(b \rightarrow b\text{-baryon})$ , as described in the note “Production and Decay of  $b$ -Flavored Hadrons.”

For inclusive branching fractions, e.g.,  $B \rightarrow D^\pm \text{anything}$ , the values usually are multiplicities, not branching fractions. They can be greater than one.

$b$ -baryon ADMIXTURE DECAY MODES ( $\Lambda_b, \Xi_b, \Sigma_b, \Omega_b$ )	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$p \mu^- \bar{\nu} \text{anything}$	$(5.3^{+2.2}_{-1.9}) \%$	—	DESIG=8
$p \ell^- \bar{\nu}_\ell \text{anything}$	$(5.1 \pm 1.2) \%$	—	DESIG=9
$p \text{anything}$	$(63 \pm 21) \%$	—	DESIG=10
$\Lambda \ell^- \bar{\nu}_\ell \text{anything}$	$(3.4 \pm 0.6) \%$	—	DESIG=5
$\Lambda/\bar{\Lambda} \text{anything}$	$(36 \pm 7) \%$	—	DESIG=7
$\Xi^- \ell^- \bar{\nu}_\ell \text{anything}$	$(5.9 \pm 1.6) \times 10^{-3}$	—	DESIG=1

**NOTES**

[a] Not a pure measurement. See note at head of  $\Lambda_b^0$  Decay Modes.

LINKAGE=X40

[b] Here  $h^-$  means  $\pi^-$  or  $K^-$ .

LINKAGE=HEX